

D2.6 Business Model Report

Turkey



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 646554

Index

- Introduction 3
 - Current Electricity Market Framework and Regulation..... 4
- 1. Business model report: Residential Single Family 8
 - Segment environment..... 8
 - Segment Drivers 8
 - Business Models..... 9
 - Business Model: Net Metering..... 9
- 2. Business model report: Commercial-Office Building and Factory 13
 - Segment environment..... 13
 - Segment Drivers 13
 - Business Models..... 14
 - Business Model: Self-consumption..... 14
- 3. Business model report: Industrial Parks and Universities 17
 - Segment environment..... 17
 - Segment Drivers 17
 - Business Models..... 18
 - Business Model: Self-consumption..... 18

Introduction

Located in the southernmost part of Europe in a sunny belt, Turkey is very advantageous in terms of solar potential and has abundant solar energy resources. Turkey has three main streamline north 1400-1450 kWh/sqm/a, middle 1550-1600 kWh/sqm/a and south 1750-1800 kWh/sqm/a.

Currently solar energy is mostly used for domestic hot water production however the interest for photovoltaic applications increasing. The country was left behind by many other European countries in the sector despite the need and the potential. High and stable energy demand growth, government support system, land availability, the saturation of the photovoltaic industry in the neighboring and Western European countries, high solar energy potential and public interest and acceptance are the enhancing elements behind the existing and anticipated rise of interest for photovoltaic system investments in Turkey. The country is now on the threshold of a solar energy revolution that could add a lot to the increasing economic growth.

The prices of turn-key projects have substantially decreased from 2012 to 2014. From the 2,000 EUR/kW_{el} in 2012, the prices for turn-key projects have decreased even below 1,000 EUR/kW_{el} for systems larger than 750 kW in installed capacities. Due to economies of scale, this ratio does not withhold for projects with less installed capacity. The main reason behind this sharp fall could well be related to the potential boom in the Turkish PV industry. During the last four years several investments for PV module production facilities from both domestic and international investors have been initiated with the government's support scheme. With the regulations and the market potential leading to a growth of appetite and tendency to invest and enhance competition, experienced suppliers and EPC companies and investors from the countries with in which PV sector is almost saturated are flocking to the PV sector and consequently the race amongst them results in a further decrease in the prices. The market has witnessed another sharp fall in the prices in November 2013; right after the government raised the licensing limit from 500 kW_{el} to 1 MW_{el}.

Limited financial options and lack of grants slow the market development down. Most banks are relatively new to the technology and may not evaluate the profitability of PV projects and do not accept the project itself as collateral yet due to PV system not having proven themselves in the Turkish market. Thus most PV projects are shelved as they fail to find advantageous financing options. The interest from several foreign financing institutions such as EBRD, EIB, JBIC and World Bank and the development agencies of Turkey are

unfortunately not satisfying the hunger in the market. Leasing and power purchase agreements are now growing but it is unclear how soon these models will be accustomed.

Current Electricity Market Framework and Regulation

Turkish financial market is volatile as of spring 2014. The unstable exchange rate between Turkish Lira and foreign currency is heavily affecting investments. Most PV systems being foreign originated come with investment costs in foreign currency and result in financial problems for the investor even though the income with the feed-in-tariff set by the government is also based on foreign currency. The investors find it hard to finance their projects especially if their original income is in TRY.

The incentives are not found sufficient by most investors interested in PV applications in Turkey. The relatively low feed-in-tariff compared to the other European countries such as Greece which offers PV solar feed-in-tariffs at 45 USD cents/kWh compared to 13.3 USD cents/kWh of Turkey, make the investments pay back in longer years. While the set tariff may be seen as a price only to support those investors aiming long term profitability and to draw a step by step growth for the industry, it surely filters and prevents some investors enter the market.

The feed-in-tariff (FiT)(13,3 USD cents/kWh) is guaranteed for 10 years only and it is not clear what will happen following the tenth year. Any plant to benefit from the active feed-in-tariff needs to connect to the grid before the end of 2020 bylaw. No segment differentiation is defined yet bylaw, meaning regardless of the size of the capacity all PV installations connected to the grid receive the same FiT.

Law No 6446, Turkish Electricity Market Law enacted in March 2013, and the License Regulation updates most recently in November 2013 state the requirement of a license to be obtained from the Energy Market Regulatory Authority (EPDK) in order to generate electricity in the Turkish Electricity Market. The law together with Turkish Commercial Code that came into force in July 2012 requires the licensees to be either joint stock companies or limited liability partnerships.

License applications for all renewables except for solar and wind is open continuously whereas there has been only one single period during which solar applications were accepted by the government in June 2013. While the results to the applications were not announced as of April 2014, these projects are projected to be finished by the end of 2015 and thus the installed capacity in Turkey is expected to exceed 600 MW by that date. As

June 2014 witnessed applications totalling over 9 GW, approximately fourteen-fold of the open capacity, the assessment is expected to take some more while. YEGM, the General Directorate of Renewable Energy, in the meantime announced another intake of applications for April 2015.

The projects with installed capacities under 1 MW do not require a license to connect to the grid, with the regulation published on the Official Gazette of Turkey in October 2013. [44] This figure, what was 500 kW prior to the announcement, does not apply for projects aiming to feed self- consumption of facilities and not connect to the national grid. Therefore projects that aim to meet self-consumption only can go beyond 1 MW however those over 1 MW may not benefit from the feed-in-tariffs due to the lack of license. This way high electricity tariffs charged to commercial customers will encourage many to offset their electricity consumption through unlicensed commercial-scale projects. All unlicensed PV projects must be approved by the Turkish Electricity Distribution Company (TEDAS). Currently the resources available at TEDAS, the capacity being the most important one, are the limiting factor that determines the rate at which unlicensed projects are completed. This has created a significant amount of uncertainty in this market segment since the rate of project approvals may not increase in the near future. Real persons and companies are exempt from establishing joint stock companies or limited liability partnerships to generate electricity and benefit from the incentives. For grid connection, under 1 MWel projects apply to the local DSOs and pay grid usage fees to the DSO for electricity fed into or received from the grid once they can connect.

The privilege of unlicensed projects aim to enhance electricity generation for meeting own energy demands therefore to be eligible for the under 1 MW regulation, companies need to show a consumption point. However the regulation does not specify any minimums regarding the consumption point resulting in a loophole through which many companies or real persons show the consumption data of a light bulb.

Reduced energy prices make PV use for self-consumption less profitable. Relatively the electricity price in Turkey is not high and for industrial and agricultural facilities it is even lower. Such plants, despite having available land or roofs for PV instalments, do not see the conversion to self-generation of electricity through PV lucrative since buying it directly from the grid makes more sense.

Several self-consumption interests may be related to avoiding electricity costs, being an example, introducing a green company image and peak shaving. The attractiveness of the

self-consumption systems however depend on the load profile, the ratio between the production and consumption and the electricity tariff of the investor. Although many factories in the Organized Industrial Zones (OIZ) of Turkey are quite interested in building solar systems on the rooftops of their plants, such systems are usually not quite profitable since all OIZs of Turkey enjoy very low electricity prices which results in the unprofitability of solar investments most of the time. For such situations OIZ managements try to utilize its own power through the companies within the OIZ and generate income for the whole zone rather than buying electricity from the grid.

Projects that aim to meet self-consumption only can go beyond 1 MW however those over 1 MW may not benefit from the feed-in-tariffs due to the lack of license. This way high electricity tariffs charged to commercial customers will encourage many to offset their electricity consumption through unlicensed commercial-scale projects. All unlicensed PV projects must be approved by TEDAS.

According to the Electricity Market Law (EML), the distribution sector in Turkey would be run by the regional monopolies with the licenses given by Energy Market Regulatory Authority (EMRA). Under the frame of the energy sector liberalization studies, the distribution of Turkey's network was split into 21 regions according to the geographical vicinity, managerial structure, energy demand and other technical and/or financial factors.

Bilateral agreements are not subject to the consent of EMRA under the current system. Therefore, licensed companies can enter into energy purchase agreements between themselves or with third parties. EML mainly puts the resuscitation of the electricity market as its goal by supporting the bilateral agreements. These agreements do not put a limit to the pricing, sales condition and/or agreement periods therefore the convenience of the agreements is very much supportable.

Apart from the feed in tariffs, several other support mechanisms are in practice for enhancing renewable energy investment nationwide. Turkish Transmission Company, TEIAS and the distribution companies give priority to the connection of renewable energy power plants. The distribution companies are also enforced to procure renewable power in up to 20% of its consumption in their supply to ineligible customers. RES power plants pay only 1% of the regular licensing fee and are exempt from the annual license fee for the first 8 years in operation. They are also bound to pay only 15% of the system usage fees for the first 5 years. The same reduction of 85% applies on fees related to transportation and transmission infrastructure investments as well.

The most important driver in the industry is indubitably the feed-in-tariff placed by the government. Among all renewable energy technologies, the support scheme for PV plants has the highest tariff at 0.133 USD per kWh injected to the grid. Considering the market price as of January 2014 is about 0.088 USD/kWh, the return on investment seems promising for such technologies. Apart from the base tariff the existence of domestic product support scheme makes the deal more profitable resulting in a lucrative market.

Due to the different reasons explained above regarding the applicability of the sectors, the following report will describe the following application segments in Turkey as following: 1) Residential Single Family; 2) Commercial Office Building and Factory; and 3) Industrial Parks and Universities.

Regarding the sector boundaries and facts explained above the applicable business models are limited. Consequently the following sections of the report are explaining only two business models which are actively used; Net-metering and Self-consumption.

The description of the Net-metering model is presented under Residential Single Family Segment.

Self-consumption model is described under Commercial Office Building and Factory and under Industrial Parks and Universities. The PV financing and legal conditions are the same for industrial and education segments. For this reason only one example is presented with the name Industrial Parks and Universities.

1. Business model report: Residential Single Family

Segment environment

In the scope of Unsilenced Electric Generation Regulation, the Specifications (Terms of Reference) of solar installations with 30 kWp capacity for Turkish electric market was announced in 2014. This document is especially important for small size rooftop solar installations. The road map includes information on number of steps and obligations to be followed for residential PV systems. The Specifications (terms of reference) was criticized by sector stakeholders being only up to 30 kWp capacity. After the critics it has been revised and re-announced in September 2015 with increasing the capacity to 50 kWp. With this new announcement, fees for screening of design appropriateness and acceptance procedures have been removed and this has made residential investments more attractive. This was welcomed; however, the application procedures are still not clear and easy.

The main barriers on investing in residential PV systems can be listed like;

- Cash flow difficulties due to huge amount of initial/advance investment payments,
- Lack of wider authorized sales and maintenance service availability, meaning EPCs are mainly focusing on 1 MW un-licensed market rather than micro market referring the range of 11kW to 50 kW.
- Un-matured micro green finance/loan products
- Legally rooftop of an apartment is a joint property (community property). To use some rooftops of a neighbourhood to build PV systems for an investor is nearly not possible since all flat owners should give permissions and should facilitate from the system. The application procedure for this option is also not clear. Since Power Purchase Agreement business model is not allowed for unlicensed electricity generation residential segment is not improved enough in Turkey.

Segment Drivers

The main driver for residential investments is to reduce the electricity cost while generating additional income. In addition to this, families who are curious and interested in green technology are more willing to make such an investment.

Mostly, the day consumption is very low when generally family members are outside home. The common use of electricity occurs during the night. For rooftop on-grid PV systems, the

daily generated electricity is measured and the surplus is purchased by the distribution company FiT (13,3 USD cent).

In some countries private households can consider to buy PV electricity from a third party that operates the PV system on their roof, however, third party does not exist directly in this manner in Turkey. Electricity buying and purchasing is only possible by means of local Distribution Company.

The maximum contract duration with a fixed price a private household agree is generally around 3 years. In Turkey the electricity prices are changing very frequently. So, maximum 1 year purchasing contract duration is more preferred.

Business Models

Below the business model of Turkey in the residential segment for Single Family is summarized. Currently for this segment no other business model is possible.

Business Model: Net Metering

The main driver for families to build a rooftop PV system is to make savings from electricity bill costs while creating additional income through selling the generated electricity during daylight. Residential PV based electric generation system is feeding the grid during the day. And at night families get the electricity from the grid. The difference between consumed and produced electricity is calculated and residential electricity generation is purchased based on feed-in tariff.

Because the initial investment costs are still high families mainly prefer to use a bank loan for rooftop systems. Although very few in number, there are banks having green/eco loan options with considerably lower interest rates and longer tenor periods like 5 years. Self-funding is also used by middle or upper class families.

The EPC companies are building the system and providing all necessary O&M services.

As mentioned before surplus electricity can only be purchased by electricity Distribution Company which is the grid operator and the electricity provider.

Net Metering

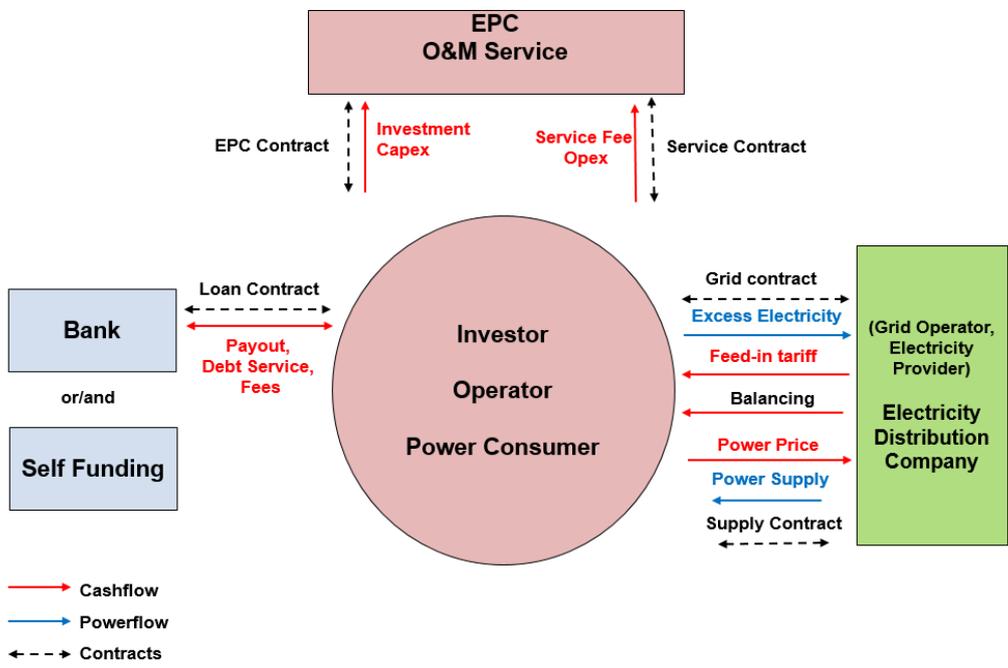


Figure 1: Net Metering

To present the cash flow of this business model, a real case with 27.102,00 TRY total system cost for 6 kWp system size is used which is placed near Istanbul where specific yield is changing between 1300-1400 kWh/qm/a. In Turkey the inflation rates and interest rates are considerably high comparing European countries like Germany or UK. And the Turkish Lira is not strong against Euro and US Dollar. The electricity price escalation is estimated as 12% per year for 20 years. Moreover, the FiT is also 13.3 USD cent fixed for 10 years. For this reason banks prefer to give loan in Euro or in US Dollar. The system payback period is 15,3 years

For this cash flow model costs are calculated with TRY currency because the electricity prices are in TRY.

PV Project			
PV System Size	kWp		6
Specific System Cost	TRY/kWp		4.517
Total System Cost	TRY		27.102
Investment Subsidy	TRY		-
Total System Cost incl. Subsidy	TRY		27.102
Fixed Operation Costs	TRY p.a.		271
Variable Operation Costs	TRY/kWh		-

PV Generation			
Specific Yield	kWh/qm/a		1320
Performance Factor	%		85%
Specific System Performance	kWh/kWp/a		1.122
Degradation	% p.a.		0,70%

Investment			
Project Duration	Years		20
Equity	TRY		5.424
Debt (Gearing)	80%	TRY	21.682
Loan Tenor	Years		5
Interest Rate	%		12,0%
Discount Rate	%		13,0%

PV Business Model			
Category	Share	Unit	Price
Feed-in Tariff	-	TRY/kWh	-
Self-consumption	-	TRY/kWh	-
Fees			
Net-metering	100%	TRY/kWh	0,3600
Fees		TRY/kWh	-
Excess Electricity		TRY/kWh	0,3300
PPA Tariff	-	TRY/kWh	-
Fees		TRY/kWh	-
Oversupply Price		TRY/kWh	-
Undersupply Penalty		TRY/kWh	-

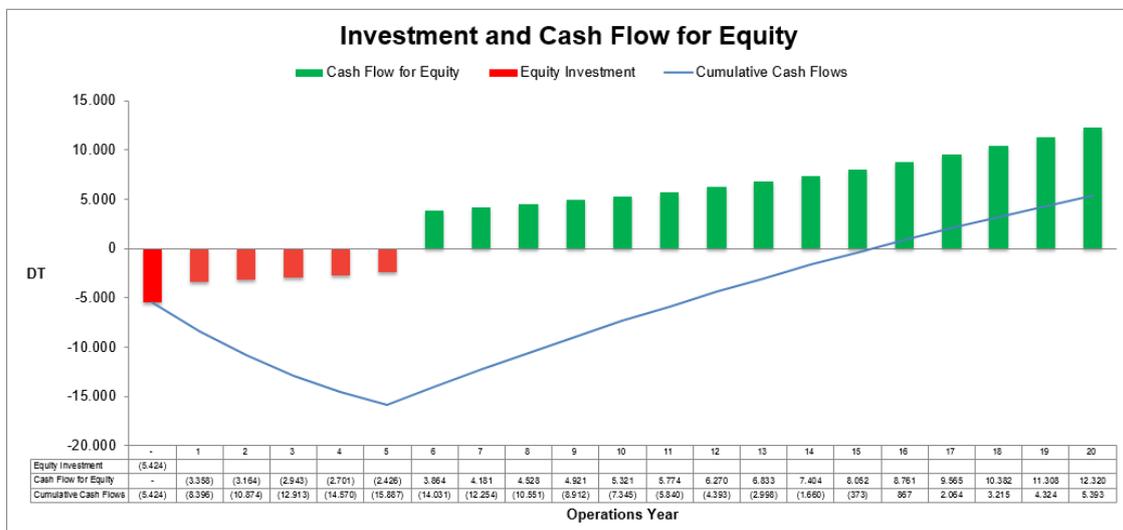
Results			
Net-Present Value		TRY	5.319
Project IRR		%	15,11%
Equity IRR		%	16,23%
Payback Period		Years	15,30
LCOE* (w/o subsidy)		TRY/kWh	0,66
LCOE (w subsidy)		TRY/kWh	0,66
Min DSCR**		x	0,44 x
Min LLCR***		x	0,51 x

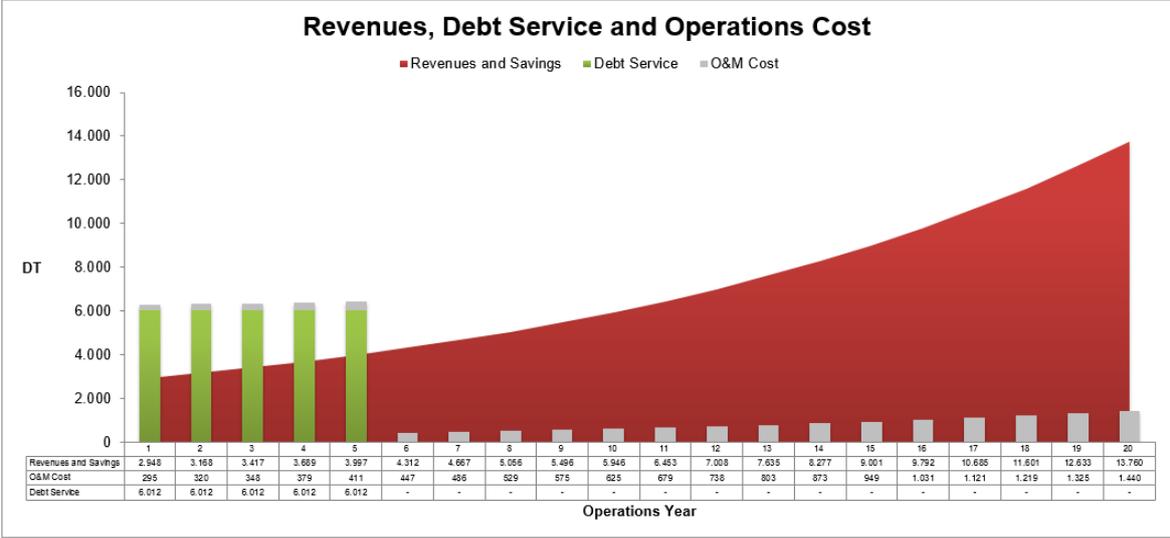
* LCOE: Levelized Cost of Electricity
 ** DSCR: Debt Service Coverage Ratio
 *** LLCR: Loan Life Coverage Ratio

Profitability Analysis

As it is shown in the figures below after 5 years of loan tenor the cumulative cash flows begin to rise and the system become profitable in 12 years.

80% of debt is used with 5 year loan tenor. Due to the electricity prices are considerably low comparing European countries and the specific yield is 1320 kWh/sqm/a this business model is not much profitable. In southern part of Turkey where specific yield is between 1750-1800 kWh/sqm/a the model becomes more profitable.





2. Business model report: Commercial-Office Building and Factory

Segment environment

PV Systems are not likely common in commercial segment. Besides the high operational costs and limited loan options provided by banks, not accepting the project itself as collateral is one of the main financial barrier for this segment. Investors or project owners have to provide extra collateral which is not easy in most cases.

Segment Drivers

PV systems are built up to create an additional income and to reduce the electricity costs of the office building. The office buildings are actively used during daylight hours and in some cases there are active buildings at night too. So PV System is providing electricity during the day and the surplus electricity is feeding the grid. Like all other segments the initial investments costs are still high for office building PV systems. It is known that some shopping malls have covered their roofs of parking places with PV panels to benefit from sunny days.

Business Models

Below you find a business model of Turkey in the Commercial Segment Office Building.

Business Model: Self-consumption

In Turkey Power Purchase Agreement business model where generally the investor, operator and power consumer are completely different parties is not legally allowed yet for unlicensed projects under 1MW. Here the agreement is done with Distribution Company and purchase price is the FiT. The owner of the PV system is using 30% of the generated electricity and sells 70% of the solar based electricity to the Distribution Company.

Debt loan is used with 15-20% equity share. EPC companies are building up the system and provide O&M services.

For commercial segment Regional Development Agencies are also an option to receive a grant.

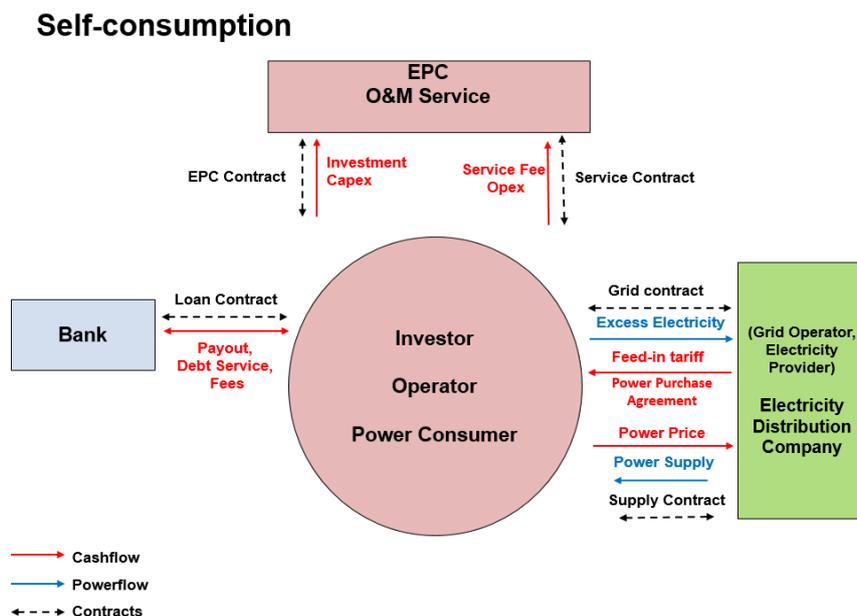


Figure 2: Self-consumption

Profitability Analysis

Due to the purchase guarantee is only 10 years the cash flow model is considered accordingly. Electricity price (0,27 TRY) for commercial entities is slightly higher than industrial companies (0,23 TRY)

An office building case is used to see the cashflow for this business model. The office building is located in Ankara. The total system cost is 2.056.435 TRY for 759 kWp. The project IRR is 17,58% and the payback period is 6,08 years. This model is becoming profitable after 7 years.

PV Project		
PV System Size	kWp	759
Specific System Cost	TRY/kWp	2.709
Total System Cost	TRY	2.056.435
Investment Subsidy	TRY	-
Total System Cost incl. Subsidy	TRY	2.056.435
Fixed Operation Costs	TRY p.a.	48.946
Variable Operation Costs	TRY/kWh	-

PV Generation		
Specific Yield	kWh/qm/a	1702
Performance Factor	%	83%
Specific System Performance	kWh/kWp/a	1.408
Degradation	% p.a.	0,70%

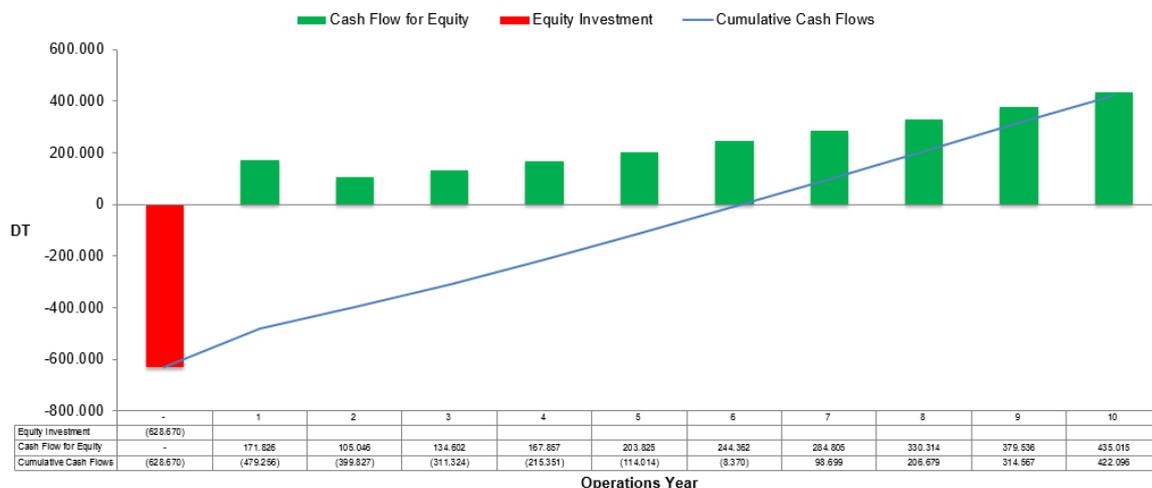
Investment		
Project Duration	Years	10
Equity	TRY	628.670
Debt (Gearing)	70%	TRY 1.439.504
Loan Tenor	Years	10
Interest Rate	%	12,3%
Discount Rate	%	15,0%

PV Business Model			
Category	Share	Unit	Price
Feed-in Tariff	-	TRY/kWh	-
Self-consumption	30%	TRY/kWh	0,2700
Fees		TRY/kWh	-
Net-metering	-	TRY/kWh	-
Fees		TRY/kWh	-
Excess Electricity		TRY/kWh	-
PPA Tariff	70%	TRY/kWh	0,3800
Fees		TRY/kWh	0,0750
Overysupply Price		TRY/kWh	-
Undersupply Penalty		TRY/kWh	-

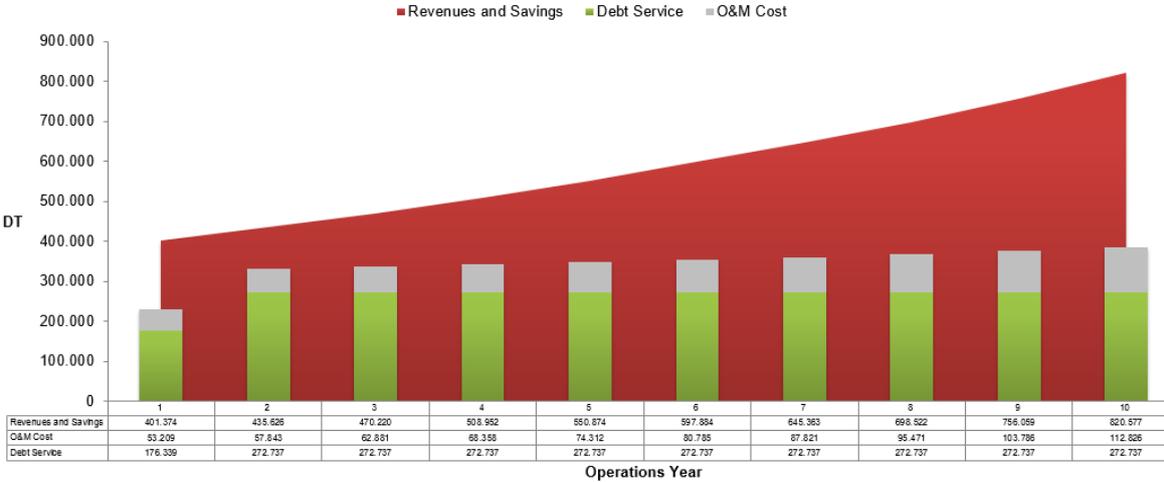
Results		
Net-Present Value	TRY	397.628
Project IRR	%	17,58%
Equity IRR	%	26,62%
Payback Period	Years	6,08
LCOE* (w/o subsidy)	TRY/kWh	0,44
LCOE (w subsidy)	TRY/kWh	0,44
Min DSCR**	x	1,39 x
Min LLCR***	x	1,82 x

* LCOE: Levelized Cost of Electricity
 ** DSCR: Debt Service Coverage Ratio
 *** LLCR: Loan Life Coverage Ratio

Investment and Cash Flow for Equity



Revenues, Debt Service and Operations Cost



3. Business model report: Industrial Parks and Universities

Segment environment

In Turkey the application procedures for licenced and un-licenced PV plants are different. The projects over 1MW are obliged to attend a tender to get a licence. OIZs are legally recognised as free-electricity producers with the Renewable Energy Law. Under this law with the regulation called Support Mechanism for Renewable Energy (SMRE), the Organized Industrial Zones and Universities that generate their own electricity are exempted for the obligation to follow the licenced procedure for over 1 MW investments. If the institutions decide to sell their electricity to third parties they have to apply for the licence. The “less than 1 MW” producers can sell the electricity (net-metering) only as a service fee. The existing legislation does not allow them to invoice the electricity itself.

OIZs are generating their own electricity to sell it to their members with 6-8 USD cent/kWh. While calculating the return period for PV plant investments they have to use their own price instead of the electricity feed in tariff which is 13.3 USD cent. In this case, the return period of this kind of investment increases to 12-15 years rather than 7-10 years. Since they have produced their own energy or supplied electricity from the grid with lower prices due to bulk purchasing power, such a new expensive investment is not so attractive at the beginning.

OIZs can build up PV solar capacity with more than 1 MW without license legislation duties (i.e. un-licensed) and should consume all electricity for their member companies. If in case the generated energy exceeds the need of the OIZ and if OIZ decides to feed the grid, in this condition OIZ should apply for license process to be energy seller. This procedure is also challenging and expensive.

Segment Drivers

The main driver was to show a good practice in generating electricity for self-consumption specifically for OIZs, proving that generating solar electricity is possible. Another driver was to reduce the electricity cost.

Business Models

Below you find the business model of Turkey in the Industrial Segment with the specific case Gebze Guzeller Organized Industrial Park. The education segment environment and business model is exactly the same with industrial parks. Both universities and organized zones are exempted from the licensing procedures and they are allowed to act like Distribution Companies. Up to this date no any university or organized industrial zone has such an application. All PV systems build in universities or industrial parks are for self-consumption only. For this reason education segment business model can be considered as same with industrial segment.

Gebze Guzeller Organized Industrial Zone is located in Kocaeli province which is the neighbor province of Istanbul. The OIZ is placed in Marmara Region which is the most concentrated and most active industrial region in Turkey.

The ground-mounted solar plant with 500kW capacity built for self-consumption. The predicted annual generation is 640.000 kWh and the annual performance is expected to be 1271 kWh/kWp.

Business Model: Self-consumption

In Turkey the grid operator and electricity provider are the same entity as Distribution Companies.

EPC companies are building the PV plants and providing O&M services regarding the contract made for 3-5 years.

For source of funding loan can be taken by banks, grants can be received by Regional Development Agencies and/or equity share can be also used.

The management of the industrial zone received 400.000,00 TL grant from Marmara Regional Development Agency and 1.385.000,00 TL with 7 years loan tenor from European Bank for Reconstruction and Development through Turkish Sustainable Energy Financing Facility (TurSEFF) Program via one of partner banks.

Self-Consumption

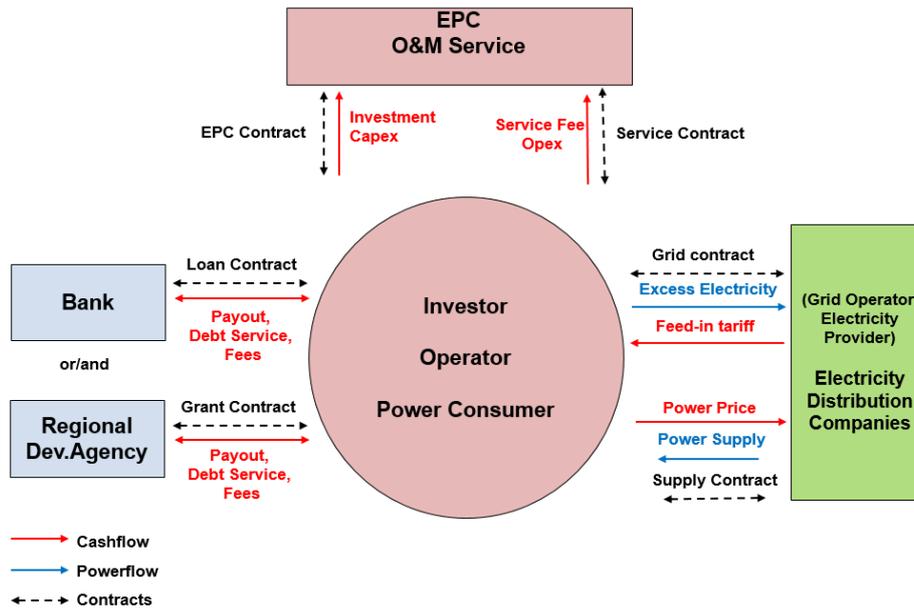
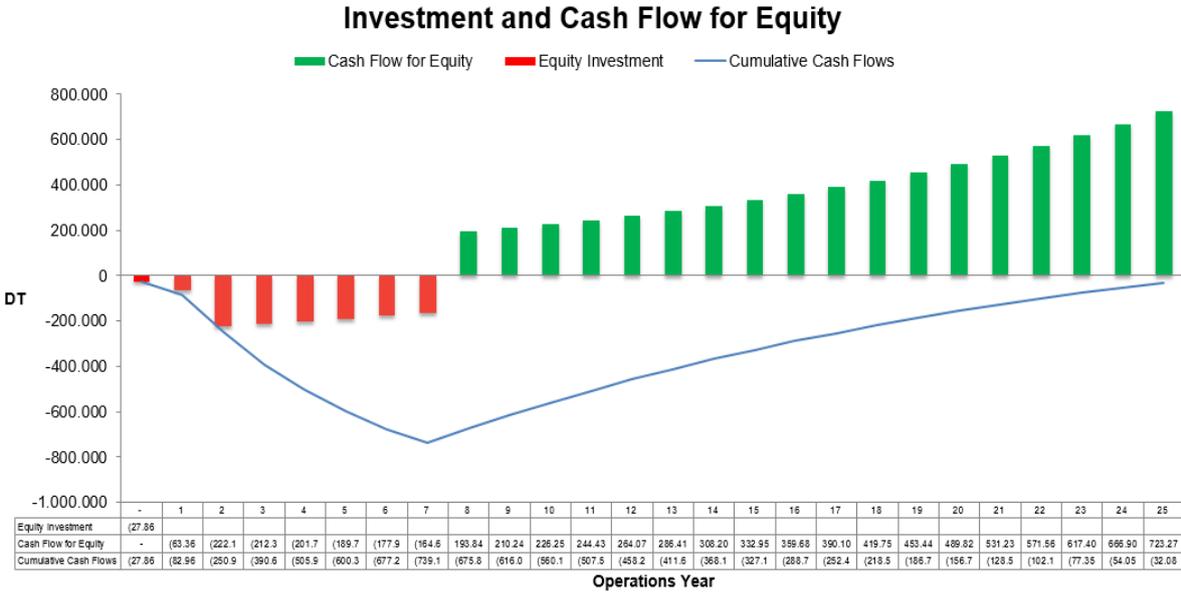


Figure 3: Self-consumption

PV Project			PV Business Model			
PV System Size	kWp	500	Category	Share	Unit	Price
Specific System Cost	TRY/kWp	3.570	Feed-in Tariff	-	TRY/kWh	-
Total System Cost	TRY	1.785.000	Self-consumption	100%	TRY/kWh	0,2300
Investment Subsidy	TRY	400.000	Fees		TRY/kWh	-
Total System Cost incl. Subsidy	TRY	1.385.000	Net-metering	-	TRY/kWh	-
Fixed Operation Costs	TRY p.a.	41.775	Fees		TRY/kWh	-
Variable Operation Costs	TRY/kWh	-	Excess Electricity		TRY/kWh	-
			PPA Tariff	-	TRY/kWh	-
			Fees		TRY/kWh	-
			Overysupply Price		TRY/kWh	-
			Undersupply Penalty		TRY/kWh	-
PV Generation			Results			
Specific Yield	kWh/qm/a	1495	Net-Present Value		TRY	(31.342)
Performance Factor	%	85%	Project IRR		%	13,67%
Specific System Performance	kWh/kWp/a	1.271	Equity IRR		%	14,54%
Degradation	% p.a.	0,70%	Payback Period		Years	-
			LCOE* (w/o subsidy)		TRY/kWh	0,55
			LCOE (w subsidy)		TRY/kWh	0,46
			Min DSCR**		x	0,35 x
			Min LLCR***		x	0,42 x
			* LCOE: Levelized Cost of Electricity			
			** DSCR: Debt Service Coverage Ratio			
			*** LLCR: Loan Life Coverage Ratio			
Investment						
Project Duration	Years	25				
Equity	TRY	27.865				
Debt (Gearing)	100%	TRY 1.385.000				
Loan Tenor	Years	7				
Interest Rate	%	12,8%				
Discount Rate	%	15,0%				

Profitability Analysis

Electricity prices in industrial segment are quite low in Turkey. Comparing with European countries due to the high inflation rate Turkey's operational costs are much higher and this makes the business model unattractive. It would work better in southern regions of Turkey where specific yield is 1750-1800 kWh/sqm/a.



After 7 years when debt loan has finished the revenues and savings continue to increase slightly.

